Remarks

Claims 1 and 19-22, 24, 27-34, 36, an 39-48 are pending in the application upon entry of the above amendment. Claims 1, 19-21, 30-33 and 42-48 have been withdrawn from consideration pursuant to a restriction requirement. Claims 23, 25, 26, 35, 37 and 38 have been cancelled by the herein amendment. All claim cancelations and amendments are without prejudice to the filing of one or more continuing applications.

The amendment to claim 22 finds support in claims 1 and 26. Further support can be found at paragraph [0025] of the amended specification, and in Example 1, paragraphs [0066] and [0067], which illustrates the effect of electron beam irradiation on molecular weight distribution.

The amendment to claim 34 has support in claims 30 and 38. Further support can be found at paragraph [0025] and in Example 1, paragraphs [0066] and [0067].

Claims 27 and 39 have been amended to change dependency from cancelled claims.

Response to Claim Objections

Claims 22 to 29 and 34 to 41 have been amended such that they are no longer dependent on the withdrawn claims.

Response to Claim Rejections Under 35 USC §112

Claims 22 and 34, and the claims dependent thereon, have been rejected on the basis that the limitation "the molecular weight distribution of the implantable substrate has been altered" is allegedly unclear as to the nature and degree to which the molecular weight distribution has been altered. Claims 22 and 34 have been amended such that they specify that the molecular weight distribution of the substrate is *reduced*. It is clear from the paragraph [0025] and in the context of the application that the use of electron beam irradiation will reduce the molecular weight distribution of the substrate.

Claims 23 and 35, and the claims dependent thereon, have been rejected on the basis that the limitation "a graded molecular weight distribution" is unclear and confusing as to what the

applicant regards as a *graded* molecular weight distribution. Claims 23, 25, 35 and 37 which all contained this limitation have been deleted. Furthermore, new claims 22 and 34 have been amended to further define that the implantable substrate has a molecular weight distribution that "changes gradually" from the surface to the core. The amendment overcomes the rejection.

Response to 35 USC §102 and §103 Rejections

The Invention

The invention of the present application provides bioabsorbable implants such as surgical screws, etc., having a molecular weight distribution that changes gradually from the surface to the core. Bioabsorbable implants are known in the art. However, the existing implants have a uniform molecular weight distribution. As pointed out at paragraph [0005] of the present application, bioabsorbable polymer implants generally break down by *in vivo* hydrolysis into lactic acid and glycolic acid. The polymers generally degrade by bulk erosion, as the rate at which water penetrates the material exceeds the rate at which chain scission occurs within the polymer. Degradation in the interior of the device may occur faster than on the surface due to autocatalysis. The implication of this is that the device remains as a space-filler long after the useful strength of the polymer has deteriorated. The ingrowth of natural tissue is prevented, and a "lactide-burst" of low pH material may be released when the surface of the implant is finally degraded, which can damage surrounding cells and cause inflammation.

The bioabsorbable implant of the present invention has an advantageous absorption profile such that the product decays gradually, thereby eliminating "lactide-burst" which can result in reddening, inflammation and pain for patients months after the implant has lost its useful strength. This absorption profile is enabled by the graded molecular weight which distribution ensures that degradation occurs gradually, therefore eliminating the "lactide-burst" which is associated with implantable substrates without a graded molecular weight.

Response to 35 USC §102 Rejection

Claims 22, 28 to 29, 34 and 40 to 41 have been rejected as being allegedly anticipated by

Shalaby. The applicant notes that Shalaby teaches absorbable biomedical devices and implantable substrates which have been modified using exposure to electron beam irradiation. However, Shalaby does not teach a bioabsorbable implantable substrate having a molecular weight distribution that changes gradually from the surface to the core wherein the average molecular weight of the implantable substrate is greater at the core than at the outer surface and wherein the rate of bioabsorbability of the core is less than the rate of the bioabsorbability at the outer surface. Claims 22 and 34, as amended, recite these distinguishing features. These claims, and their dependent claims, therefore do not lack novelty over Shalaby. Withdrawal of the Section 102 rejection is requested.

Response to 35 USC §103 Rejection

Claims 23, 25 to 27, 35 and 37 to 39 have been rejected as being unpatentable under Section 103 over Shalaby in view of Campbell. Specifically, the Examiner notes that Shalaby is applied to the claims for the same reasons as given under 35 USC §102 but notes that Shalaby does not explicitly disclose the substrates having a graded molecular weight distribution. However, the Examiner goes on to explain that he believes that Campbell teaches a coating layer having a graded molecular weight distribution using bioabsorbable polymeric materials with different molecular weight, where the polymer of highest molecular weight may be closest to the surface of an implant and the polymer of lowest molecular weight farthest from the implant. Thus, the Examiner believes that it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the polymeric materials of Campbell with the absorbable biomedical devices of Shalaby to arrive at the claimed invention. The Examiner alleges that the skilled artisan would have been motivated to do so for such desirable properties to control degradation rate of the polymeric materials by altering the molecular weight of the polymers as evidenced by Campbell.

The applicant submits that Campbell discloses drug releasing gradient coatings for medical devices wherein the gradient coatings comprise at least two layers where at least one of these layers incorporates a pharmaceutical compound. It is clear from Campbell paragraphs [0012] and [0013] that the devices in Campbell are for coating on top of medical devices. For

example, at paragraph [0012] the highest molecular weight polymer is placed next to the outer surface of the implant which is contrary to the present invention. As recited in claims 22 and 34, the average molecular weight of the implantable substrate is greater at the core than at the outer surface.

It is also clear that, due to the laminated nature of the material of Campbell, the molecular weight distribution does not change gradually from the surface to the core but changes in steps, each step being associated with a new material and a new layer. As such, Campbell clearly teaches that it is necessary to use more than one layer (i.e., different polymeric materials) to achieve a stepped change in material properties. Therefore, Campbell clearly teaches away from the present invention which enables the production of a bioabsorbable implant, which does not require a coating, and which has a polymer having a gradient molecular weight from the core to the surface, and which therefore does not have a stepped change in material properties.

Even assuming *arguendo* that on of ordinary skill in the art would have been motivated to combine Shalaby and Campbell, which is not admitted, he would not have arrived at the claimed invention of the present application. Neither document describes or leads to the preparation of a bioabsorbable implantable substrate having a molecular weight distribution that changes gradually from the surface to the core, wherein the average molecular weight is greater at the core than the outer surface, and wherein the molecular weight distribution of the implantable substrate has been reduced by exposing a portion of the implantable substrate to electrode beam irradiation. Thus, the combination of the asserted references does not result in the present invention.

Moreover, Campbell, the only document that speaks of a drug release gradient, teaches that implants should be coated in two or more different polymeric materials so that different medicaments can be released at different rates. Campbell does not discuss the bioabsorbability of implants, but teaches adding further layers (at least two) to implants which would in fact decrease the bioabsorbability of the implant. Thus Campbell teaches away from the present invention.

The subject matter of claims 23, 25 to 27, 35 and 37 to 39 would not therefore have been

obvious to one of ordinary skill in the art at the time the invention was made. Reconsideration and withdrawal of the Section 103 rejection is respectfully requested.

Conclusion

The claims remaining in the application are believed to be in condition for allowance. An early action toward that end is earnestly solicited.

Respectfully submitted,

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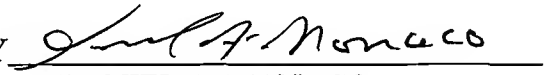
BY 

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